

PCT

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY (Chapter I of the Patent Cooperation Treaty)

(PCT Rule 44bis)

Applicant's or agent's file reference 042933/303037	FOR FURTHER ACTION	See item 4 below
International application No. PCT/US2004/014194	International filing date (<i>day/month/year</i>) 07 May 2004 (07.05.2004)	Priority date (<i>day/month/year</i>) 24 November 2003 (24.11.2003)
International Patent Classification (8th edition unless older edition indicated) See relevant information in Form PCT/ISA/237		
Applicant NOKIA CORPORATION		

1. This international preliminary report on patentability (Chapter I) is issued by the International Bureau on behalf of the International Searching Authority under Rule 44 *bis*.1(a).

2. This REPORT consists of a total of 8 sheets, including this cover sheet.

In the attached sheets, any reference to the written opinion of the International Searching Authority should be read as a reference to the international preliminary report on patentability (Chapter I) instead.

3. This report contains indications relating to the following items:

- | | |
|--|---|
| <input checked="" type="checkbox"/> Box No. I | Basis of the report |
| <input checked="" type="checkbox"/> Box No. II | Priority |
| <input type="checkbox"/> Box No. III | Non-establishment of opinion with regard to novelty, inventive step and industrial applicability |
| <input type="checkbox"/> Box No. IV | Lack of unity of invention |
| <input checked="" type="checkbox"/> Box No. V | Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement |
| <input type="checkbox"/> Box No. VI | Certain documents cited |
| <input type="checkbox"/> Box No. VII | Certain defects in the international application |
| <input type="checkbox"/> Box No. VIII | Certain observations on the international application |

4. The International Bureau will communicate this report to designated Offices in accordance with Rules 44bis.3(c) and 93bis.1 but not, except where the applicant makes an express request under Article 23(2), before the expiration of 30 months from the priority date (Rule 44bis .2).

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland	Date of issuance of this report 08 May 2007 (08.05.2007)
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PATENT COOPERATION TREATY

From the
INTERNATIONAL SEARCHING AUTHORITY

To:
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PCT

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

(PCT Rule 43bis.1)

Date of mailing
(day/month/year)

23 APR 2007

Applicant's or agent's file reference

NC 17671 (9015.075)

FOR FURTHER ACTION

See paragraph 2 below

International application No.

PCT/US04/14194

International filing date (day/month/year)

07 May 2004 (07.05.2004)

Priority date (day/month/year)

24 November 2003 (24.11.2003)

International Patent Classification (IPC) or both national classification and IPC

IPC: H04J 9/00(2006.01);H04Q 7/24(2006.01);H04L 27/00(2006.01)

USPC: 370/204,338;375/299

Applicant

NOKIA CORPORATION

1. This opinion contains indications relating to the following items:

- ☒ Box No. I Basis of the opinion
- ☒ Box No. II Priority
- ☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- ☐ Box No. IV Lack of unity of invention
- ☒ Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- ☐ Box No. VI Certain documents cited
- ☐ Box No. VII Certain defects in the international application
- ☐ Box No. VIII Certain observations on the international application

2. FURTHER ACTION

If a demand for international preliminary examination is made, this opinion will be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA") except that this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notified the International Bureau under Rule 66.1bis(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of 3 months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.

For further options, see Form PCT/ISA/220.

3. For further details, see notes to Form PCT/ISA/220.

Name and mailing address of the ISA/ US

Mail Stop PCT, Attn: ISA/US
Commissioner for Patents
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Alexandria, Virginia 22313-1450

Facsimile No. (571) 273-3201

Date of completion of this opinion

01 March 2007 (01.03.2007)

Authorized officer

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INTERNATIONAL SEARCHING AUTHORITY

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Box No. I Basis of this opinion

1. With regard to the **language**, this opinion has been established on the basis of:

- ☒ the international application in the language in which it was filed
- ☐ a translation of the international application into _____, which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1(b)).

2. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application and necessary to the claimed invention, this opinion has been established on the basis of:

a. type of material

- ☐ a sequence listing
- ☐ table(s) related to the sequence listing

b. format of material

- ☐ on paper
- ☐ in electronic form

c. time of filing/furnishing

- ☐ contained in the international application as filed.
- ☐ filed together with the international application in electronic form.
- ☐ furnished subsequently to this Authority for the purposes of search.

3. ☐ In addition, in the case that more than one version or copy of a sequence listing and/or table(s) relating thereto has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.

4. Additional comments:

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Box No. II Priority

1. ☐ The validity of the priority claim has not been considered because the International Searching Authority does not have in its possession a copy of the earlier application whose priority has been claimed or, where required, a translation of that earlier application. This opinion has nevertheless been established on the assumption that the relevant date (Rules 43*bis*.1 and 64.1) is the claimed priority date.
2. ☒ This opinion has been established as if no priority had been claimed due to the fact that the priority claim has been found invalid (Rules 43*bis*.1 and 64.1). Thus for the purposes of this opinion, the international filing date indicated above is considered to be the relevant date.
3. Additional observations, if necessary:
The priority claim is considered invalid because none of the claims are supported by the priority application.

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Box No. V Reasoned statement under Rule 43 *bis*.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Claims <u>12-15, 18-20</u>	YES
	Claims <u>1-11 16-17</u>	NO
Inventive step (IS)	Claims <u>NONE</u>	YES
	Claims <u>1-20</u>	NO
Industrial applicability (IA)	Claims <u>1-20</u>	YES
	Claims <u>NONE</u>	NO

2. Citations and explanations:

Please See Continuation Sheet

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Supplemental Box

In case the space in any of the preceding boxes is not sufficient.

V. 2. Citations and Explanations:

1. Claim 1 - 11 and 16 - 17 lack novelty under PCT Article 33(2) as being anticipated by Thielecke et al. (US 2004/0052315)

Regarding Claims 1, 16, Thielecke teaches in a communication system having a sending station for sending communication data upon a communication channel susceptible to distortion (Figure 2, the data will be transmitted over an RF channel, which is susceptible to distortion such as noise and fading), an improvement of apparatus for placing the communication data in a form to facilitate the communication thereof upon the communication channel, said apparatus comprising: a first mapper adapted to receive first representations of a first portion of the communication data (Figure 2, Sections 0042, 0051, the modulators also read on the claimed mappers), said first mapper for mapping the first representations of the first portion of the communication data into first mapped values according to a first mapping scheme (Sections 0042, 0051, the modulators can use a plurality of modulation/mapping schemes thus there will be a first mapping scheme); a second mapper adapted to receive second representations of a second portion of the communication data (Sections 0042, 0051), said second mapper for mapping the second representations of the communication data into second mapped values according to a second mapping scheme (Sections 0042, 0051, the modulators can use a plurality of modulation/mapping schemes thus there will be a second mapping scheme), the second mapping scheme exhibiting a mapping property that differs with the first mapping scheme (Sections 0042, 0051, the modulators (18a, 18b) can use a plurality of modulation/mapping schemes thus modulator (18a) can use a modulation/mapping scheme that differs from the modulation/mapping scheme of modulator (18b)); a set of antenna transducers comprising a first antenna transducer and at least a second antenna transducer (Figure 2, antenna transducers (2a,2b), at least a selected one of the antenna transducers of said set adapted to receive at least parts of the first mapped values and the second mapped values formed by said first mapper and said second mapper, respectively (Sections 0045 - 0047, 0050 - 0054, the first mapped values and second mapped values are superimposed), the at least the selected one of the antenna transducers of said set for transducing the first and second mapped values, respectively, applied thereto into electromagnetic form for communication upon the communication channel (Figure 2, 0045 - 0047, 0050 - 0054, the first mapped values and second mapped values are superimposed).

Regarding Claim 2, Thielecke teaches all of the claimed limitations recited in Claim 1. Thielecke further teaches a first encoder adapted to receive the first portion of the communication data, said first encoder for encoding the first portion of the communication data according to a first encoding techniques (Figure 2, Section 0042, the encoders 13a, 13b can use a plurality of encoding techniques) and wherein the first representations of the first portion of the communication data to which said first mapper is adapted to receive comprise first-encoded values formed by said first encoder (Figure 2).

Regarding Claim 3, Thielecke teaches all of the claimed limitations recited in Claim 1. Thielecke further teaches a

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In case the space in any of the preceding boxes is not sufficient.

second encoder adapted to receive the second portion of the communication data, said second encoder for encoding the second portion of the communication data according to a second encoding technique (Figure 2, Section 0042, the encoders 13a, 13b can use a plurality of encoding techniques) and wherein the second representations of the second portion of the communication data to which said second mapper is adapted to receive comprise second-encoded values formed by said second encoder (Figure 2).

Regarding Claim 4, Thielecke teaches all of the claimed limitations recited in Claim 1. Thielecke further teaches wherein the first mapped values into which said first mapper maps the first representations of the first portion of the communication data comprises a first set of mapped values, wherein the second mapped values into which said second mapper maps the second representations of the second portion of the communication data comprise a second set of mapped values, elements of the first set of mapped values differing in value with elements of the second set of mapped values (Section 0051, the modulators (18a, 18b) can use a plurality of modulation/mapping schemes thus modulator (18a) can use a modulation/mapping scheme that differs from the modulation/mapping scheme of modulator (18b), since the mapping schemes differ the elements of the mapped values for each scheme will differ in value).

Regarding Claim 5, Thielecke teaches all of the claimed limitations recited in Claim 4. Thielecke further teaches wherein the first set of mapped values and the second set of mapped values formed by said first mapper and said second mapper, respectively, are formed of mutually-exclusive elements (Section 0051, since the mapping schemes differ the elements of the mapped values for each scheme will differ in value and will be mutually-exclusive).

Regarding Claim 6, Thielecke teaches all of the claimed limitations recited in Claim 4. Thielecke further teaches wherein the mapping property exhibited by the second mapping scheme that differs with that of the first mapping scheme comprises vector magnitudes that differ (Section 0051, the modulators (18a, 18b) can use a plurality of modulation/mapping schemes thus modulator (18a) can use a modulation/mapping scheme that differs from the modulation/mapping scheme of modulator (18b), said modulation schemes will have differing constellations and thus differing vector magnitudes).

Regarding Claim 7, Thielecke teaches all of the claimed limitations recited in Claim 1. Thielecke further teaches wherein the first mapped values into which said first mapper maps the first representations of the first portion of the communication data comprise a first set of mapped values that exhibits first geometric differences there between, wherein the second mapped values into which said second representations of the second portion of the communication data comprise a second set of map values that exhibit second geometric differences there between (Section 0051, the modulators (18a, 18b) can use a plurality of modulation/mapping schemes thus modulator (18a) can use a modulation/mapping scheme that differs from the modulation/mapping scheme of modulator (18b), said modulation schemes will have differing constellations and thus differing vector magnitudes, since the constellations differ the geometric differences between the values or states of the first constellation will differ from the geometric differences between the values or states of the second constellation).

Regarding Claim 8, Thielecke teaches all of the claimed limitations recited in Claim 7. Thielecke further teaches wherein the first geometric differences between the mapped values of the first set and the second geometric differences between the mapped values of the second set are mutually exclusive (Section 0051, since the constellations differ the geometric differences between the values or states of the first constellation will differ from the geometric differences between the values or states of the second constellation, since said geometric differences are associated with mapped values that are mutually exclusive the geometric differences will be mutually exclusive).

Regarding Claim 9, Thielecke teaches all of the claimed limitations recited in Claim 7. Thielecke further teaches wherein the mapping property exhibited by the second mapping scheme that differs with that of the first mapping scheme comprises second geometric differences that differ in lengths with lengths of the first geometric differences (Section 0051, since the constellations differ the geometric differences between the values or states of the first constellation will differ from the geometric differences between the values or states of the second constellation, said geometric properties comprise lengths thus the lengths will differ).

Regarding Claim 10, Thielecke teaches all of the claimed limitations recited in Claim 1. Thielecke further teaches wherein the mapping by which said first mapper maps the first representations and the mapping by which said second mapper maps the second representations are together selected to define a layered code having combined values that are applied to the at least selected one of said set of antenna transducers (Sections 0045 - 0047, 0050 - 0054, the first mapped values and second mapped values are superimposed rendering a layered, combined characteristic).

Regarding Claim 11, Thielecke teaches all of the claimed limitations recited in Claim 1. Thielecke further teaches wherein the at least selected one of the antenna transducers at which the at least parts of the first and the second mapped values, respectively, are received comprise the first antenna transducer and the at least the second antenna transducer (Figure 2, Sections 0045 - 0047, 0050 - 0054, the superimposed data).

Regarding Claim 17, Thielecke teaches all of the claimed limitations recited in Claim 16. Thielecke further teaches transducing the selected first mapped values and the selected second mapped values applied during said operation of selectably applying into electromagnetic form and delivering, by way of the communication channel, the selected first and second mapped values, respectively, to the receiving station (Figures 2, 3).

2. Claims 12 - 15 and 18 - 20 lack an inventive step under PCT Article 33(3) as being obvious over Thielecke et al. (US 2004/0052315) in view of Ketchum (US 6,731,668)

Regarding Claims 12, 18, Thielecke teaches all of the claimed limitations recited in Claims 1, 17. Thielecke further teaches a receiving station for receiving the communication data once communicated upon the communication channel

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(Figure 3, Sections 0059 - 0061), a further improvement of apparatus for the receiving station for facilitating detection of the communication data, said apparatus comprising: a decoder, which exploits the difference in mapping properties between the first and second set (Figure 3, Sections 0059 - 0061), adapted to receive indications of the communication data communicated upon the communication channel and delivered to the receiving station (Figure 3).

Thielecke does not teach a maximum likelihood decoder, which exploits the difference in mapping properties between the first and second set, adapted to receive indications of the communication data communicated upon the communication channel and delivered to the receiving station, said maximum likelihood decoder for determining a maximum likelihood path that defines selection of values of the communication data, the maximum likelihood path selected from amongst a set of possible paths, each defining communication data value possibilities.

Ketchum teaches a maximum likelihood decoder for determining a maximum likelihood path that defines selection of values of the communication data, the maximum likelihood path selected from amongst a set of possible paths, each defining communication data value possibilities (Column 3 lines 19 - 26, Column 8 lines 45 - 60).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the receiver of Thielecke with the Viterbi decoder of Ketchum as an alternative means of decoding a received signal thus providing an information sequence with a minimal number of errors as taught by Ketchum.

Regarding Claim 13, Thielecke in view of Ketchum teaches all of the claimed limitations recited in Claim 12. Ketchum further teaches wherein the set of possible paths from amongst which said maximum likelihood decoder selects the maximum likelihood path comprises fewer than all of the possible paths (Column 3 lines 19 - 26).

Regarding Claims 14, 20, Thielecke in view of Ketchum teaches all of the claimed limitations recited in Claims 12, 19. Ketchum further teaches wherein the set of possible paths from amongst which said maximum likelihood decoder selects the maximum likelihood path is selected responsive to a mapping scheme pursuant to which a mapper maps representations (Column 3 lines 19 - 26). Thielecke further teaches a first and second mapping scheme (Sections 0042, 0051, the modulators can use a plurality of modulation/mapping schemes).

Regarding Claims 15, Thielecke in view of Ketchum teaches all of the claimed limitations recited in Claims 14. Ketchum further teaches wherein the set of possible paths from amongst which said maximum likelihood decoder selects the maximum likelihood path is selected responsive to a mapping scheme pursuant to which a mapper maps representations (Column 3 lines 19 - 26). Thielecke further teaches a first and second mapping scheme (Sections 0042, 0051, the modulators can use a plurality of modulation/mapping schemes).

Regarding Claim 19, Thielecke in view of Ketchum teaches all of the claimed limitations recited in Claim 18. Ketchum further teaches prior to said operation of decoding, of selecting the set of possible paths from which the maximum likelihood path is formable (Column 3 lines 19 - 26).

3. Claim 1 - 20 meet the criteria set out in PCT Article 33(4), and thus have industrial applicability because the subject matter claimed can be made or used in industry.